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FORTIETH ANNUAL REPORT

Fiscal Year Ending June 30, 1929

OF THE

Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

M. J. FUNCHESS, *Director*

AUBURN, ALABAMA

TRANSMITTALS

Alabama Polytechnic Institute,
Auburn, Alabama.

President Bradford Knapp,
Auburn, Alabama.

Dear Doctor Knapp:

I have the honor to submit herewith the Fortieth Annual Report of the Agricultural Experiment Station of the Alabama Polytechnic Institute.

Yours very truly,

M. J. Funchess,
Director.

Alabama Polytechnic Institute
Auburn, Alabama.

Governor Bibb Graves,
Montgomery, Alabama.

Dear Sir:

I take pleasure in transmitting to you the Fortieth Annual Report of the Alabama Experiment Station of the Alabama Polytechnic Institute.

Yours very truly,

Bradford Knapp,
President.

ALABAMA POLYTECHNIC INSTITUTE

COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

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M. J. Funchess, M.S.. Director of Experiment Station
W. H. Weidenbach, B. S.. Secretary
P. O. Davis, B.S. Agricultural Editor
Mary E. Martin, Librarian

Agronomy and Soils:

M. J. Funchess, M. S.	Agronomist
F. W. Parker, Ph. D.	Soil Chemist
W. H. Pierre, Ph. D.	Associate Soil Chemist
J. W. Tidmore, Ph. D.	Associate Soil Chemist
H. B. Tisdale, M. S.	Associate Plant Breeder
J. T. Williamson, B. S.	Associate Agronomist
R. Y. Bailey, B. S.	Assistant Agronomist
G. D. Scarseth, M. S.	Assistant Soil Chemist
D. G. Sturkie, M. S.	Assistant Agronomist
F. E. Bertram, B. S.	Assistant in Agronomy
L. B. Brackeen, B. S.	Assistant in Agronomy
G. H. Jester, B. S.	Assistant in Agronomy
W. D. Lucas, B. S.	Assistant in Agronomy
E. L. Mayton, B. S.	Assistant in Agronomy
J. A. Naftel, B. S.	Assistant in Agronomy
Clarence Savage, B. S.	Assistant in Agronomy

Animal Husbandry and Dairying:

J. C. Grimes, M. S.	Animal Husbandman
W. D. Salmon, A. M.	Research Professor of Animal Nutrition
J. E. Ivey, M. S.	Poultry Husbandman
N. B. Guerrant, Ph.D.	Research Associate Professor of Animal Nutrition
S. J. Schilling, D. V. M.	Research Associate Professor of Animal Nutrition
W. C. Taylor, B. S.	Assistant in Animal Industry

Agricultural Chemistry:

E. R. Miller, Ph.D.	Research Chemist
A. D. Staples, B. S.	Assistant Research Chemist

Agricultural Economics:

J. D. Pope, M. S.	Agricultural Economist
C. G. Garman, B. S.	Assistant Agricultural Economist
H. T. Wingate, B. S.	Assistant in Agricultural Economics
E. M. Slights	Statistical Assistant

Agricultural Engineering:

M. L. Nichols, M. S.	Agricultural Engineer
J. W. Randolph, M. S.	Assistant Agricultural Engineer
Ellis Diseker, B. S.	Assistant in Agricultural Engineering

Botany and Plant Pathology:

W. A. Gardner, Ph.D.	Botanist
J. L. Seal, Ph.D.	Associate Plant Pathologist
G. L. Fick, M. S.	Assistant Botanist

Entomology:

J. M. Robinson, M. A.	Entomologist
L. L. English, Ph.D.	Associate Entomologist
F. S. Arant, M. S.	Assistant in Entomology

Farm Management:

J. F. Duggar, M. S.	Professor of Farm Management

Home Economics Research:

Helen Dumond Herren, A. B., A. M.	Assistant in Home Economics

Horticulture and Forestry:

C. L. Isbell, Ph.D.	Horticulturist
W. D. Kimbrough, Ph.D.	Assistant Horticulturist
O. C. Medlock, M. S.	Assistant Horticulturist
R. W. Taylor, M. S.	Assistant Horticulturist

Agricultural Substations:

Fred Stewart, B. S.	Superintendent, Tennessee Valley Substation, Belle Mina, Alabama.
R. C. Christopher, B. S.	Superintendent, Sand Mountain Substation, Crossville, Ala.
J. P. Wilson, B. S.	Superitnendent, Wiregrass Substation, Headland, Alabama.

CHANGES IN STATION STAFF DURING 1928-1929.

Appointsments:

J. L. Seal, Ph.D.	Associate Plant Pathologist
S. J. Schilling, D. V. M.	Research Associate Professor of Animal Nutrition
O. C. Medlock, M. S.	Assistant Horticulturist
G. D. Scarseth, M. S.	Assistant Soil Chemist
W. C. Taylor, B. S.	Assistant in Animal Industry
Ellis Diseker, B. S.	Assistant in Agricultural Engineering
W. D. Lucas, B. S.	Assistant in Agronomy
E. L. Mayton, B. S.	Assistant in Agronomy
Fred Stewart, B. S.	Superintendent, Tennessee Valley Substation
R. C. Christopher, B. S.	Superintendent, Sand Mountain Substation
J. P. Wilson, B. S.	Superintendent, Wiregrass Substation

Resignations:

W. H. Pierre, Ph.D.	Associate Soil Chemist
F. E. Bertram, B. S.	Assistant in Agronomy
Clarence Savage, B. S.	Assistant in Agronomy

NEW PUBLICATIONS

The Influence of Various Nitrogenous Fertilizers on the Availability of Phosphate and Potassium. (J. F. Fudge).—*Alabama Experiment Station Bulletin* 227. This study was made on a number of soils from greenhouse work and samples of soil from plots of long-continued experiments conducted by the New Jersey, Alabama, Rhode Island, Pennsylvania, and North Carolina Experiment Stations. Availability was studied by determining the concentration of phosphate and potassium in displaced solutions and in extracts of soils, and by the Neubauer or plant seedling methods.

Acid-forming fertilizers caused a marked decrease in phosphate availability and an increase in water-soluble potassium. Physiologically basic fertilizers caused an increase in phosphate availability and a decrease in water-soluble potassium.

The influence of the individual fertilizers, based on the study of the soils from the long-continued experiments, is summarized.

CONTRIBUTIONS TO SCIENTIFIC JOURNALS

Pierre, W. H., and Parker, F. W.—**The Use of Collodion Sacks in Soil Investigations.** *Proc. First Intern. Congress Soil Sci.*, II, pp. 396--406. Studies of the use of collodion sacks in obtaining clear soil extracts for colorimetric determinations of H ion concentration, nitrate, potassium, and phosphates are reported. The use of collodion sacks in determining the buffer capacity of soils is also described.

Pierre, W. H., and Worley, S. L.—**The Buffer Method and the Determination of Exchangeable Hydrogen for Estimating the Amounts of Lime Required to Bring Soils to Definite pH Values.** *Soil Sci.*, 26, pp. 363-375. The two methods are described and data given to show the pH values obtained after liming soils with the amounts indicated by the methods. In the case of the buffer method, it was found necessary to use a factor of 1.5 to calculate the amount of lime necessary to bring soils to the pH values desired. Soils limed according to their content of exchangeable hydrogen were brought to a pH value of 6.5.

AGRONOMY AND SOILS

Rotation Experiments. (R. Y. Bailey).—The Old Rotation experiment was started in 1896. This experiment includes plots cropped continuously to cotton and corn with and without legumes, a two-year rotation of cotton and corn with legumes, and a three-year rotation of cotton, corn and oats with legumes. Plots on which legumes were turned under produced twice as much cotton and corn during the nine-year period, 1920-1928, as plots which received no legumes. There was no material difference in the yields on plots planted continuously to corn and cotton and those on which two- and three-year rotations were followed.

The Cullars Rotation experiment was started in 1911 for the purpose of studying the relative value of rock phosphate and superphosphate in a three-year rotation. The rotation includes both summer and winter legumes that are turned under before cotton and corn are planted. Rock phosphate has produced approximately the same yields of corn and oats as superphosphate. Average yields for the eight-year period, 1921-1928, show that superphosphate produced 82 pounds of seed cotton per acre more than rock phosphate. Superphosphate was applied at the rate of 544 pounds and rock phosphate at the rate of 1,088 pounds per acre. Each plot received uniform applications of potash and nitrogen.

Three additional treatments were started in 1914 to study the value of legumes in the rotation. Average results for eight years, 1921-1928, show that the plots having legumes in the rotation produced 377 pounds of seed cotton, 22.1 bushels of corn and 7.1 bushels of oats per acre more than the plots which had no legumes; these received 480 pounds of superphosphate and 100 pounds of muriate of potash per acre in the rotation.

Time of Turning Vetch for Cotton and Corn. (F. E. Bertram).—In two experiments vetch was turned for cotton and corn on three different dates, about March 25, April 5, and April 15. Planting was about ten days after the date of turning. Average yields for four years show that cotton following vetch turned about March 25 made 63 pounds of seed cotton per acre more than cotton following vetch turned about April 5, and 163 pounds of seed cotton per acre more than the plot turned April 15. Nitrate of soda applied at the rate of 300 pounds per acre made only 6.7 pounds of seed cotton per acre more than vetch turned early and 178 pounds more than vetch turned April 15. The planting dates for the corresponding nitrate of soda and vetch plots were the same.

Corn following vetch turned about March 25 made an average yield of 20.3 bushels of corn per acre as compared with 27 bushels and 28.8 for vetch turned April 5 and April 15, respectively. Vetch turned March 25 made the same yields as 200 pounds of nitrate of soda and 6.6 bushels more than 100 pounds of nitrate of soda per acre, the planting date for the three plots

being the same. Corn following vetch turned April 5 made 5.9 bushels more than 200 pounds of nitrate of soda and 2.1 bushels more than 300 pounds of nitrate of soda per acre. Vetch that was turned March 15 made 6.3 bushels of corn more than 200 pounds of nitrate of soda and 2.8 bushels more than 400 pounds of nitrate of soda, all three plots being planted at the same time. The above yields are an average of four years. Vetch was killed by cold in 1928 and the averages represent a comparison of three crops of vetch with four applications of nitrate of soda.

A Comparison of Manure, Commercial Fertilizer, and Vetch for Cotton and Corn. (F. E. Bertram).—This experiment was started in 1925 to compare the effects of stable manure, nitrate of soda, and vetch turned under on yield of cotton and corn. Stable manure, nitrate of soda, and vetch produced 35.1, 35.1, and 31.8 bushels per acre, respectively. Stable manure made an average yield of 1,486 pounds of seed cotton per acre as compared with 1,248 pounds of nitrate of soda and 1,248 pounds for vetch. Vetch was killed by cold in 1928 while the fertilized plots were fertilized according to the regular plan of the experiment.

Nitrate of Soda vs. Sulfate of Ammonia for Cotton. (R. Y. Bailey).—An experiment comparing nitrate of soda and sulfate of ammonia for cotton on limed and unlimed plots has been carried on since 1925. Results given in Table 1 show little difference in yield on the limed plots. The unlimed plots show a marked difference in yield in favor of nitrate of soda, particularly where the heavier application was made.

Table 1.—Cotton Yields on Nitrate of Soda vs. Sulphate of Ammonia Experiment

Plot	Nitrogenous fertilizer.* Pounds per acre	Pounds of seed cotton per acre	
		1928	4-yr. average 1925-1928
	Limed		
1	400 Nitrate of soda**	1,333	1,173.1**
2	300 Sulphate of ammonia	1,408	1,245.3
3	None	620	772.0
4	200 Nitrate of soda	1,036	1,069.0
5	150 Sulphate of ammonia	946	1,046.0
	Unlimed		
6	400 Nitrate of soda	1,117	1,033.0
7	300 Sulphate of ammonia	853	825.6
8	None	543	657.2
9	200 Nitrate of soda	825	925.0
10	150 Sulphate of ammonia	862	848.0

* All plots received 800 pounds of acid phosphate and 200 pounds of muriate of potash per acre annually.

** Plot 1 was badly washed by heavy rain the first year of the experiment.

Cotton Variety Tests. (H. B. Tisdale).—Twenty-six varieties and strains of cotton were tested in Talladega, Cherokee, Limestone, Calhoun, Lee, and Autauga counties. The following list shows the five highest yielding varieties and the yield of lint cotton per acre for the north and central sections of Alabama.

North Alabama Average 14 Tests 1925-1928		Central Alabama Average 8 Tests 1925-1928	
D. P. L. 4	390	Cook 1627	482
Cook 1627	384	Cook 588	478
Cook 1010	382	Dixie Triumph	472
Delfos	366	D. P. L. 4	466
Piedmont Cleveland	364	Cook 1616	466

Nineteen varieties and strains of wilt-resistant cotton were tested in Lee, Autauga, Covington, and Lowndes counties. The average results of thirty tests over a period of six years, 1923-1928, show the yield of lint cotton per acre from the highest yielding varieties to be as follows: Cook 307-6, 385; Dixie Triumph, 371; Toole Council, 365; Lewis 63, 359; Toole Petty, 359.

Corn Variety Tests. (H. B. Tisdale).—Twenty-two varieties and strains of corn were tested in Marion, Calhoun, and Lee counties. The following list shows the five highest yielding varieties with the yield in bushels of grain per acre for North and Central Alabama. The tests in South Alabama were inconclusive on account of bad stands.

North Alabama Average 11 tests 1922-1928		Central Alabama Average 7 tests 1922-1928	
Weekley	23.3	Whatley	28.6
Douthit	22.4	Douthit	27.4
Pee Dee No. 5	22.2	Weekley	27.0
Whatley	22.1	Hastings	26.1
Hastings	22.0	Pee Dee No. 5	26.0

Cotton and Corn Breeding. (H. B. Tisdale).—A number of better strains of Cook 1627, Cook 1010, Bottoms, and Cook 307-6 wilt-resistant varieties of cotton were isolated from plant-to-row tests and multiplied. The improvement of these varieties and strains of cotton is being done in cooperation with several farmers in different parts of the state who are able to produce a large amount of pure seed for distribution. The improvement of the staple length of these varieties of cotton is one of the main objects of the work. It is very difficult to maintain a uniform or satisfactory length of staple, as this characteristic is greatly affected by the weather conditions during the growing season.

Several promising hybrids of leading varieties of cotton are being studied for the improvement of staple and yield.

Several pure lines of the Whatley variety of corn are being established. These pure lines will be cross pollinated and studied for increase in yield and disease resistance.

Cowpea and Soybean Mixtures for Hay. (R. Y. Bailey).—Seven years work comparing cowpeas, soybeans, Sudan grass, and different mixtures of these, sown broadcast or in drills, has been conducted. Sorghum in drills made a higher yield of hay than any other single crop or combination of crops. Combinations of cowpeas and sorghum, and cowpeas and Sudan grass sown broadcast have made the next highest yields of hay.

The Influence of Superphosphate Used in Connection with Winter Legumes on Yield of Cotton. (J. T. Williamson).—Superphosphate used with winter legumes caused substantial increases in the yields of cotton on the experimental fields located near Hackleburg, Sylacauga, and Prattville. Without superphosphate hairy vetch made poor growth on all of these fields; with superphosphate the increased growth of the winter legumes plus the mineral plant food was sufficient to give an average annual increase in yield of 405 pounds of seed cotton per acre at Hackleburg, 270 pounds at Sylacauga, and 257 pounds at Prattville. Table 2 shows the average annual yield of seed cotton in pounds per acre with and without superphosphate.

Table 2.—Influence of Winter Legumes With and Without Superphosphate on Yields of Cotton

Soil treatment	Average yield seed cotton per acre—pounds		
	Hackleburg 5 crops	Sylacauga 6 crops	Prattville 6 crops
Winter legume only	757	278	427
Winter legume and 600 pounds superphosphate*	1,162	548	684

* Two-thirds of the superphosphate applied to the winter legume, one-third to cotton.

Further results obtained on the experiment fields showed that the value of minerals depends on the time they are applied relative to the crop that follows. On one plot all of the materials were applied to the vetch crop which preceded cotton, while on another two-thirds was applied to vetch and one-third to the cotton crop which followed. As measured in terms of seed cot-

Table 3.—Influence of Time of Applying Superphosphate and Potash on Yield of Cotton

Time of applying phosphate and potash*	Average yield seed cotton per acre—pounds		
	Hackleburg 5 crops	Sylacauga 6 crops	Prattville 6 crops
All to winter legume	1,325	754	823
Two-thirds to winter legume and one-third to cotton	1,456	928	932

* 600 pounds superphosphate and 100 pounds muriate of potash per acre.

ton per acre, the "split" application was the more effective by 131 pounds at Hackleburg, 174 pounds at Sylacauga, and 109 pounds at Prattville. Table 3 records the average yields per acre in pounds of seed cotton from these two plots on each of the three fields.

Phosphate Studies in Solution Cultures. (J. W. Tidmore).—In recent years considerable work has been done concerning the minimum concentration of phosphate required for maximum growth of plants in solution cultures. In these experiments, however, the phosphate concentrations were not adequately maintained.

The influence of the phosphate concentration of the culture solution on the rate of PO_4 absorption, plant growth, buffer capacity of the plant sap, and the rate of PO_4 absorption as influenced by the reaction of the culture solution was studied using very large volumes of culture solution.

The phosphate concentrations used in this study were 0.05, 0.10, 0.20, and 0.50 p.p.m. PO_4. Corn, sorghum, and tomatoes were grown for several weeks in 1000-liter culture vessels so that the phosphate concentrations of the culture solution could be maintained approximately constant.

The rate of PO_4 absorption was not directly proportional to the PO_4 concentration of the culture solution. The rate of growth increased with increasing phosphate concentrations throughout the growing period. Maximum growth of corn, sorghum, and tomatoes was obtained at 0.50 p.p.m. PO_4. Corn and sorghum made a very good growth at 0.20 p.p.m. PO_4 while tomatoes made a poor growth at this concentration.

Phosphate played a minor role as a buffer material in the plant sap under the conditions of this experiment.

Corn and wheat plants absorbed PO_4 more rapidly from acid than from alkaline culture solutions. There was no appreciable difference in the rate of PO_4 absorption from culture solutions having a reaction of pH 4.0, 5.0, and 6.0

Growth and Yields of Kudzu as Influenced by Frequency of Cutting and Reserve Root Storage. (W. H. Pierre and F. E. Bertram).—In a comparison of one, two, four, and six cutting treatments, it was found that one cutting gave the highest yield and that as the number of cuttings increased the yields progressively decreased. The differences in yield as a result of the different cutting treatments increased as the experiment continued. These results were due to the fact that frequent cuttings decreased the amount of root storage. The total weight of the roots of the plants cut frequently was not only lower but the percentage of reserve carbohydrates and nitrogen was considerably lower than that of the plants cut less frequently. The reserve carbohydrates were present in the form of starch and dextrins. An increase in the moisture content of the roots accompanied the lower percentage of reserve food. Two cuttings per season

are recommended because good yields of hay, having a good quality, are obtained and root growth and storage are permitted.

The Percentage Base Saturation of Different Soils at Similar pH Values. (W. H. Pierre).—This study was made for the purpose of determining to what extent the H ion concentration of soils represents the condition of soils with respect to the percentage base saturation. Several widely different soils were brought to similar pH values by treatment with lime or acid-forming nitrogenous fertilizers; determinations were made of their content of exchangeable hydrogen and the total exchange capacity. From these values the percentage base saturation was calculated.

Similar values were obtained for soils which had similar origins while large differences were obtained between soils of widely different geologic origins. Most of the Alabama soils studied were found to be between 30 and 40 per cent saturated at pH 5.0 and between 50 and 60 per cent saturated at pH 6.0. Several soils from the central prairie region gave considerably higher percentages of base saturation at these values. A brown silt loam soil of alluvial origin from Mississippi gave the highest percentage of base saturation at the various pH values. This soil was found to be 79 per cent saturated with bases at pH 5.0. A black clay loam obtained from Illinois was found to give the second highest value, being 62 per cent saturated at pH 5.0. The reason for the differences in the percentage of base saturation of soils at similar pH values is being investigated.

Plant Growth on Acid Soils as Influenced by H Ion Concentration, Percentage Base Saturation, and Concentration of Aluminum in the Displaced Soil Solution. (W. H. Pierre).—Several soils of different geologic origin from Alabama and other states were brought to various degrees of acidity by using lime and acid or acid-forming nitrogenous fertilizers in greenhouse pots. Corn, sorghum, and barley were grown on these soils in the order named. Determinations of the H ion concentration were made on the soils before and after growing each crop. Before the soils were planted to sorghum, their displaced solutions were analyzed for various elements including aluminum.

It was found that the H ion concentration at which plants were definitely injured varied considerably for the different soils. A soil from Mississippi produced practically as high a yield of sorghum at pH 4.5 as at 6.5, while a Cecil sandy loam from South Carolina produced only about 2 per cent as high a yield at pH 4.8 as at 6.5. Moreover, these results could not be explained on the basis of differences in the aluminum content of their displaced solution because both had about the same concentration. When the different soils were compared, no correlation was obtained between plant injury and the concentration of aluminum in the displaced soil solutions.

Studies were also made of the percentage base saturation of

the soils at the various pH values. The results obtained indicated that the percentage base saturation of soils is an important factor in determining plant injury on acid soils. The Mississippi soil referred to was over 70 per cent saturated at pH 4.5 while the Cecil soil from South Carolina was less than 30 per cent saturated at pH 4.8. Such a correlation between plant injury and percentage base saturation, however, was not obtained with all soils studied. These results suggest the need for more study of the factors causing plant injury on acid soils.

The Fixation of Superphosphate by Soils as Influenced by Time of Contact. (L. G. Brackeen).—Twelve representative soils of this state were obtained, fertilized, and placed in two-gallon pots. Superphosphate was mixed with the soil in all pots, except the checks, at the rate of 600 pounds per acre, being applied at the time of planting, 30, 90, or 180 days before planting. In addition, each soil received muriate of potash and nitrate of soda at the rate of 50 or 400 pounds per acre, respectively. The soils were planted to Sudan grass.

The fixation of phosphate in the soils which had been in contact with the superphosphate during the periods mentioned above was studied by determining the amounts of $P0_4$ which were soluble in water (1:5), 0.001N H_2S0_4 (1:100), or 0.2N $HN0_3$ (1:5). The amount of plant growth obtained was also considered as an indication of the available $P0_4$. The average results for the twelve soils are shown in Table 4.

Table 4.—The Relative Fixation of Phosphate as Determined By the Methods Indicated

Method	Superphosphate and soil contact—days			
	1	30	90	180
Plant growth	100	82	80	73
0.2 N nitric acid-soluble	100	65	57	51
0.001 N sulfuric acid-soluble	100	47	40	39
Water-soluble	100	19	14	13

The heavy soils fixed phosphate to a greater extent than the light soils, as would be expected. A fair correlation existed between the crop yields and the extracted phosphates regardless of the method of extraction. The best correlation was found between yields and the 0.2 N nitric acid-soluble phosphate and the second best correlation existed between yields and .001N sulfuric acid-soluble phosphate.

Black Belt Soil Investigations. (George D. Scarseth).—*Field Studies*: There are approximately 2,331,000 acres of land in the Alabama Black Belt soil province. It is estimated that 30 per cent of this area is in Sumter clay, 25 per cent in Oktibbeha clay, 11 per cent in Eutaw clay, 6 per cent in Lufkin clay, and

only 5 per cent in Houston clay. The remainder of the area is in Coastal Plain, and minor Black Belt soil types. Previous to this study the Houston clay had been considered to be the most abundant soil type in the Belt. Profiles from the eight major soil types were studied and soil samples collected for greenhouse and laboratory studies.

Greenhouse Studies:-

Greenhouse tests, totaling 1,054 crop units grown in two-gallon pots, were conducted to determine the response to phosphorus and potash fertilization. Nitrogen needs were not included in these tests. Sudan grass, rape, oats, soybeans, and Johnson grass were the test crops used on eight virgin and fourteen cultivated oils.

The virgin soils gave no response to potash whereas cultivated soils gave a small response. The outstanding result of these tests was the very great response to phosphorus when applied at the rate of 1000 pounds 16 per cent superphosphate per acre. High applications of superphosphate produced extraordinarily increased yields of all crops on all the soil types except on Houston clay and bottom types. On a Eutaw clay the increased growth in oats from 100 pounds of superphosphate per acre was 2600 per cent. The soybeans were the least responsive to superphosphate but on six soils the average increase with superphosphate was 394 per cent.

All tests indicated that the maximum response to superphosphate was obtained only when large amounts were applied. Experiments were conducted to test the effect of varying the rates and time of application of superphosphate on the fixation of phosphorus. Results showed that the Sumter, Oktibbeha, and Lufkin clays converted with considerable rapidity the applied phosphorus into unavailable or slowly available forms. On the Sumter and Oktibbeha clays 250 pounds of superphosphate per acre mixed into the soil 180 days before planting of the crop gave very little increased growth over the growth obtained without phosphorus; greater growth was obtained as the time of applying the superphosphate neared the time of planting. It was found that increased growth was obtained with increased applications of superphosphate and that the longer the soil and superphosphate were in contact before planting, the greater was the amount of phosphorus unavailable for the growing crop. Additional tests on the fixation and rate of applying phosphorus are in progress.

Laboratory Tests:-

The pH values of all soil samples collected give some data on the reaction of these soils. Lime requirement tests show that soils such as the Lufkin may need over 5 tons of lime per acre to bring the soil reaction from pH4.9 to 6.5, and that some Oktibbeha clays may be near neutral while others require 2 tons of lime.

Tests carried on in glass tumblers to determine the capacities of nine soils to convert phosphorus and potash into water-insoluble forms showed that when monocalcium phosphate equivalent to 4,000 pounds of superphosphate per acre was applied, over 99 per cent was made insoluble in a 1:5 soil water extract in a 5-month period. The potash was fixed to a less extent than the phosphorus.

Colloids were isolated from profile horizons of six soil types and analyzed. The SiO_2-sesquioxide ratio of the Lufkin colloid was 3.84 as compared to 1.83 for the Oktibbeha colloid. This difference indicates that the Oktibbeha is the more highly weathered soil. Eutaw clays are intermediate with a colloid having a ratio of 2.18.

ANIMAL HUSBANDRY AND DAIRYING

Winter Feeding and Time of Marketing Steers. (J. C. Grimes).—The results of this experiment agree with those of last year in that it was more profitable to limit the ration during the winter and finish on grass for the June market than to full-feed during the winter and market in the spring.

The addition of 4.5 pounds of blackstrap molasses daily to a ration of cottonseed meal and Johnson grass hay for steers that were being finished for the spring market increased the daily gains and the profits. The steers receiving molasses carried more finish at the close of the experiment and sold for $1.50 per hundred more than those receiving no molasses. These results are in agreement with the findings of last year.

The feeding of cottonseed meal to steers that were being finished on grass for the June market did not prove profitable. The steers in Lot A, receiving an average of 4.8 pounds of cottonseed meal daily on grass, made an average daily gain of 2.59 pounds at a cost of 4.52 per hundred weight, and returned a profit above feed cost of $11.19 per steer. The steers in Lot B, running on pasture and receiving no meal, gained 2.54 pounds daily at a cost of $0.86 per hundred weight and returned a profit above feed cost of $17.16 per steer. These results do not agree with those of last year when the feeding of meal proved profitable. The experiment is being repeated.

Johnson grass hay alone proved to be a satisfactory ration for wintering steers, despite the fact that the steers lost some weight during the winter. The addition of 2.12 pounds of cottonseed meal daily to a ration of Johnson grass hay resulted in a gain of 0.59 pounds daily.

Soybean Hay as a Supplement to White Corn and Tankage for Growing and Fattening Hogs. (J. C. Grimes, W. E. Sewell and W. C. Taylor).—In order to determine the value of soybean hay as a supplement to white corn and tankage for growing and fattening hogs, thirty fall pigs were divided into three uniform lots of ten animals each and fed for 84 days as follows:

Lot I.—White corn 9 parts and tankage 1 part, self-fed.
Lot II.—Yellow corn 9 parts and tankage 1 part, self-fed.
Lot III.—White corn 9 parts and tankage 1 part, self-fed, and soybean hay, self-fed.

All animals had access to a mineral mixture of charcoal, lime, and salt, equal parts by weight.

Lot I made an average daily gain of 1.27 pounds per animal at a feed cost of $11.00 per 100 pounds of gain. Lot II gained 1.47 pounds daily per animal at a feed cost of $10.28 per 100 pounds of gain. Lot III excelled both lots I and II, making 1.60 pounds of gain daily per animal at a cost of $10.12 per 100 pounds gain. The profit per animal above feed cost was for Lot I $2.30, Lot II $2.91, and Lot III $3.74. These data show that yellow corn and tankage produced more rapid and economical gains than white corn and tankage, but that white corn and tankage supplemented with soybean hay was the most efficient of the three rations.

Forage Crops for Fattening Hogs. (J. C. Grimes, W. E. Sewell and W. C. Taylor).—Thirty pigs were divided into three uniform lots and fed from February 1 to April 26 as follows:

Lot I.—Corn and tankage, self-fed, free choice, on oat and Austrian pea pasture.
Lot II.—Corn and tankage (10 parts corn to 1 part tankage), hand-fed at the rate of 3 per cent live weight of animal.
Lot III.—Corn and tankage, self-fed, free choice, in the dry lot.

A mineral mixture of equal parts by weight of steamed bone meal, air slaked lime, and salt was supplied all lots throughout the test.

Lot I gained 1.65, Lot II 1.06, and Lot III 1.64 pounds daily. The feed required to produce 100 pounds of gain was 382.1 pounds in Lot I, 258.9, in Lot II, and 404.3 in Lot III. It will be seen that the pasture saved 22 pounds of grain for each 100 pounds of pork produced in Lot I and 146 pounds of grain for each 100 pounds of pork produced in Lot II.

Based on the gain made in the different lots and the prices used in the experiment, an acre of pasture was worth $12.00 when the corn and tankage was self-fed and $26.83 when the grain ration was limited.

Improving Scrub Hogs by the Use of Purebred Sires. (J. C. Grimes, W. E. Sewell and W. C. Taylor).—A study was begun in 1926 to determine the improvement which might be made by the use of purebred sires on native scrub hogs. During the past year seven litters of pigs representing four different grades were fed to a weight of 200 pounds.

The scrub group of pigs made an average daily gain of 1.03 pounds, required 441.93 pounds of feed for each 100 pounds of gain and reached 200 pounds weight in 228 days. The 50 per

cent purebred pigs gained an average of 1.18 pounds, required 420.4 pounds feed for each 100 pounds gain and reached 200 pounds weight in 203 days. The 75 per cent purebred pigs gained an average of 1.13 pounds daily, required 369.5 pounds of feed for each 100 pounds gain and reached 200 pounds in weight in 207 days. The 87½ per cent purebred pigs gained an average of 1.21 pounds daily, required 421.72 pounds of feed for each 100 pounds gain and reached 200 pounds in weight in 192 days.

From the above figures it will be seen that with one or two exceptions the rate of gain increased, whereas the amount of feed required for a unit of gain and the length of time required to produce a 200-pound hog decreased as the percentage of pure breeding increased.

Mineral Supplements in the Dairy Ration. (W. H. Eaton).—All cows in the College herd are fed as nearly alike as conditions permit with the exception of mineral supplements. Group I receives no mineral supplement; Group II in addition to the regular ration are given 4 ounces bone meal per cow daily; Group III in addition to the regular ration are given 4 ounces marble dust per cow daily. The addition of mineral supplements has apparently had no effect on milk production.

Johnson Grass Hay Versus Timothy Hay for Horses and Mules. (J. C. Grimes).—In order to obtain information on the comparative feeding value of Johnson grass hay and timothy hay, two experiments were conducted. Oats were used as the grain in both experiments.

The first experiment was conducted with 28 horses and mules owned by the Tennessee Coal, Iron, and Railroad Company at Bessemer, Alabama. The animals were doing heavy work around the mines. The experiment started July 29, 1928 and was continued for 84 days.

The second experiment was conducted with 40 horses owned by the Military Department at Auburn, Alabama. The horses were doing light work. This experiment started December 19, 1928 and was continued for 140 days. Results of the two experiments were as follows:

In the first experiment with horses and mules doing heavy work, the ration of oats and timothy hay proved slightly more efficient in maintaining the animals' weight than did the ration of oats and Johnson grass hay. The average daily feed consumed per 1000 pounds live weight was 11.74 pounds oats and 9.40 pounds Johnson grass hay in Lot I, and 11.06 pounds oats and 9.33 pounds timothy hay in Lot II. The average loss in weight per animal during the 84 days was 21.79 pounds in Lot I, and 10.71 pounds in Lot II. The animals refused 4.97 per cent of the Johnson grass hay and 0.72 per cent of the timothy hay. The prices of feeds on the Birmingham market when this experiment was conducted were: Oats $0.85 per bushel, Johnson grass hay

$20.00 per ton, timothy hay $25.00 per ton. Based upon these figures the average daily feed cost per animal (including hay refused) was 51 cents in the Johnson grass hay lot and 52.5 cents in the timothy hay lot.

In the second experiment with horses doing light work there was no noticeable difference in the efficiency of the two hays so far as the well-being of the animal was concerned. The average daily feed allowed in the second experiment per 1000 pounds live weight was 9.49 pounds oats and 11.39 pounds Johnson grass hay in Lot III, and 9.69 pounds oats and 11.40 pounds timothy hay in Lot IV. The average gain in weight per animal during the 140-day experiment was 56.25 pounds in Lot III, and 57.70 pounds in Lot IV. The actual costs of feeds f. o. b. Auburn used in the second experiment were: oats $0.67 per bushel, Johnson grass hay $21.60 per ton, timothy hay $26.00 per ton. Based on these prices the average daily feed cost per animal was 33.9 cents in the Johnson grass hay and 37 cents in the timothy hay lot.

There was no noticeable difference in either of the experiments in the health and vigor of the animals or in their ability to do the work assigned.

Nutrition Investigations (Studies of the Vitamin B Complex and Pathological Conditions Associated with the Lack of Vitamin B Complex). (W. D. Salmon, N. B. Guerrant and S. J. Schilling).—Data reported last year led us to formulate the hypothesis that at least two active substances were present in what we had formerly considered as the P-P fraction. The results seemed to indicate that one of these substances was more intimately related to the actual growth process while the other in some way tended to inhibit the development of characteristic skin lesions. An attempt at separation and concentration of these hypothetical substances was made the basis of the work this year.

The P-P fraction had previously been shown to have an antiseptic action against the gram-positive cocci obtained from skin lesions of pellagrous rats. It was found possible to remove the major portion of the antiseptic fraction from an extract of kudzu by treating this extract with an excess of lead acetate at a slightly alkaline reaction. When the lead was removed from the precipitate and the preparation brought to near dryness and treated with acid alcohol, the alcohol-soluble portion was very effective in its antiseptic action. Concentrations of 0.05 to 0.10 per cent in broth cultures prevented visible growth of the coccus. This fraction did not support growth of rats on a vitamin B-free diet supplemented by our standard B-P solid. Feeding and injection tests have not shown it to be potent in preventing the occurrence of skin lesions on such diets.

The filtrate from the lead acetate precipitate of the kudzu extract was very weak in its antiseptic action against the coccus obtained from the skin lesions of pellagrous rats; it was fairly

potent in supporting growth when used as an adjunct to the vitamin B-free diet supplemented by our standard B-P solid. Although rats on such a regimen show a marked initial growth which may extend over a period of eight weeks or more, they eventually develop severe skin lesions. Following the development of such lesions they may cease to grow or actually decline in weight. Thus it seems that in the fractionation process some essential has been removed or inactivated, although the fraction removed was not found to prevent the occurrence of the skin lesions. We have not been successful in obtaining a marked concentration of the growth-promoting substance. The various chemical manipulations which have been attempted have been attended by disastrous losses in activity. We are now trying to determine the source of these losses.

Studies on the antiseptic action of some known chemical compounds upon the cocci obtained from skin lesions were made. Gentian violet was extremely effective, a concentration of .00005 per cent preventing visible growth in nutrient broth. Catechol, gallic acid, pyrogallol, and hydroquinine were less effective, concentrations of .0025 to .005 per cent being required to prevent growth. Tanic acid prevented growth at a concentration of .01 per cent, resorcinol at .20 per cent, phenol at .25 per cent while .50 to 1.00 per cent of phloroglucinol was required (all tests were at approximately pH 7.30). It is interesting to note that phenol crystals were less effective than some of the fractions prepared from an extract of kudzu leaves. Although gentian violet was extremely antiseptic *in vitro* it did not prevent the occurrence of symptoms of pellagra in rats on a vitamin B-free diet supplemented by B-P solid. In fact rats receiving the gentian violet lost weight more rapidly and developed pellagrous lesions earlier than the controls which did not receive gentian violet. The other antiseptics have not been tried in feeding tests.

Attempts to produce the characteristic skin lesions by transfer of inocula from pure cultures of staphyloccoccus isolated from skin lesions or from scrapings of skin lesions to lacerated or punctured areas of skin on other rats in various stages of depletion have been uniformly unsuccessful. Neither have various methods of injection of the organisms been more productive of generalized lesions such as occur spontaneously although local reactions have at times been produced by such injections.

The addition of yeast or whole milk to the diet of pellagrous rats results in a rapid improvement in the general condition of the animal; the skin lesions, however, are very refractory and tend to heal slowly.

AGRICULTURAL ECONOMICS

The Relation of the Quality of Cotton to Prices Paid to Farmers. (J. D. Pope).—Two main qualities of cotton are recognized in the cotton trade, grade and staple. Grade refers to color and

the amount of foreign material in the cotton such as trash and dirt. Staple refers to length of fiber.

Farmers have been urged to improve the quality of cotton they produce, especially the length of staple. The object of this study was to find out to what extent, if any, farmers are paid better prices for the better grades and staples than for the poorer grades and staples. The method used in the study was to collect samples of bales of cotton grown in different parts of the state, to find out what prices the farmer received for each bale, and to compare the prices the farmer received with the prices officially quoted for the different grades and staples on the Montgomery market. All samples of cotton collected were classified by the United States Department of Agriculture in accordance with the official cotton standards.

About 5,000 bales of the 1926 crop were sampled and it was found that over 80 per cent of this cotton was of middling grade or better. As to length of staple, about seven-tenths of one per cent was below 7/8", 92 per cent was 7/8", and 6 per cent was 15/16". Only about five-tenths of one percent was 1" or longer.

About 3,500 bales of the 1927 crop were sampled and about 95 per cent of this cotton was classed middling or better in grade. About 14 per cent was below 7/8" in staple, 85 per cent was 7/8", less than 1 per cent was 15/16" and a very small amount was 1" and above.

The United States Department of Agriculture made a grade and staple estimate of the entire Alabama crop of 1928. About 93 per cent of the crop was estimated to be middling and better. Twenty-three per cent of this cotton was below 7/8" in staple, 70 per cent was 7/8", 5 per cent was 15/16" and about 2 per cent was 1" and above.

It appears that the bulk of these three crops was reasonably satisfactory from the standpoint of grade but the 14 per cent of cotton below 7/8" in 1927 and the 23 per cent in 1928 was rather large since most mills require at least 7/8" in length and prefer 15/16" and 1" cotton.

As a result of comparing the prices farmers received for different grades of cotton with quotations for these different grades on the Montgomery market it appears that on the average farmers received somewhat more for the better grades than for the poorer grades. As to staple, however, there does not seem to be a marked relationship, affording little or no financial incentive to produce better staple.

It was very striking to find that the prices paid to farmers in the local markets varied a great deal for the same grade and staple purchased on the same day by the same buyer. This occurred commonly and the variations were often as much as ten dollars per bale. This indicates that cotton is not sold sufficiently accurately according to grade and staple to offer a very strong incentive to the farmer to try to produce better cotton. However, it seems that a farmer is more certain of getting a better price

for good grades as compared with poor grades than of getting a premium for good staple as compared with poor staple. Thus the study has indicated that there is no special inducement to farmers to cease growing cotton that classes less than 7/8″ in staple length since ordinarily an individual farmer will not receive a better price for a bale of 15/16″ or 1″ cotton than for a bale of 13/16″ cotton.

An Economic Study of Poultry in Marshall and DeKalb Counties, Alabama. (J. D. Pope and C. G. Garman).—In 1927, 55 small farm flocks of poultry averaging 33 hens per flock showed an average return for labor of $56. In 1928, 82 small farm flocks of poultry averaging 41 layers per flock made an average return for labor of $59. The 31 commercial flocks on which records were obtained in 1927 averaged 130 layers per flock and made a return for labor of $205. In 1928 records were obtained on 36 commercial poultry flocks which had an average of 173 layers per flock and had an average return of $224 for labor.

The average production from the small farm flocks of poultry was 103 eggs per bird in 1927 and 73 eggs per bird in 1928. The production from the commercial flocks averaged 130 eggs per bird in 1927 and 144 eggs in 1928.

In the commercial flocks 69 per cent of the total receipts was from eggs and 69 per cent of the total expense was for feed.

The cost of producing one dozen eggs in 1927 was 25 cents and in 1928, 26 cents. Feed made up 63 per cent of the cost, depreciation of the of the flocks 15 per cent, labor 13 per cent, and depreciation of building and equipment, interest, and miscellaneous items made up the balance.

The average cost of hatching chicks on the farms having commercial poultry was approximately six cents per chick in 1927 and 1928.

A high production per bird from the commercial poultry flocks was associated with high returns per bird and high returns per hour of labor spent on poultry.

A commercial flock of poultry affects the acreage of cotton a man can tend because both cotton and poultry have a labor peak in the spring of the year. It was found, however, that the men using two-horse cultivators were able to reduce this spring peak on cotton somewhat. The men using two-horse cultivators spent only 52 man-hours of pre-harvest labor per acre on cotton and the others spent 73 man-hours per acre on cotton.

AGRICULTURING ENGINEERING

Variation of the Lug Design Factors Affecting Traction. (J. W. Randolph).—The tractive results for different soils obtained by varying the factors affecting lug design were plotted as curves. In all cases the formulae for these curves were similar, varying only in the constants of the equations. The variation of

these constants appeared to depend largely upon the colloid content of the soil.

Results indicate that the general formula for figuring tractive power previously reported will hold over a wider range, if changed to include variables depending upon certain soil physical measurements. Lug depth, weight distribution, and lug volume rank in the same order of importance for the four soils.

Angle iron lugs which extend some distance beyond a rim will have an average of 11 per cent more traction if the flange is attached to the rim so that they point in a direction opposite to the wheel rotation.

Soil Dynamics Studies. (M. L. Nichols).—Studies of the friction of soil and metal showed that the increased pull caused by the adhesion of the soil to metal was due largely to the colloid content of the soil; the place in the moisture range of soil at which adhesion took place was affected by both metal and soil. The maximum cohesive power of the soils studied was also found to be in direct proportion to colloid content. A new method of measuring adhesion of soil to metal was evolved. This consisted of measuring capillary pull exerted by metal on water, and comparing to this the capillary pull of a metal whose adhesion to soil had been measured by the slider method.

A detailed study of the relation of compaction to pressure was made for four synthetic soils of known composition. It was found that compaction for a given force reached a maximum at some definite moisture percentage. This maximum increased as the colloid content increased, probably due to the tendency of the moisture films to form cell-like open structures. This structure appeared to be so constant for the different soils studied that the hypothesis is advanced that there is a "normal" soil structure for each soil depending upon these forces. Apparently the structure of soils is a function of particle size, and is a more constant property than has been generally supposed.

Farm Machinery Studies. (M. L. Nichols and E. G. Diseker). —*Plowing and Weed Control*: Various methods of plowing (including the use of the jointer and coulter), harrowing before the crop was planted, and different systems of bedding had little or no effect on subsequent weed growth, probably due to an unusually wet season.

Tests of the rotary hoe, weeder, and drag harrow for reducing the labor of hoeing showed these implements to be entirely unsatisfactory during a wet season on the red Piedmont soils.

Experiments with check-rowing corn and cotton shows this method to be practical on sandy, red Piedmont, and Black Belt soils having moderate grades (up to 5 per cent grade). By this method of planting, hoeing was completely eliminated. Thinning cotton planted by this method cost from 40 to 50 cents per acre.

Cylinder Plows: Experiments with the cylinder disc, or the Wheatland type plow, showed that it is not well adapted to typi-

cal Black Belt soils, except where previous cultivation has left the land in good tilth. This was due to its lack of penetration. The plow is entirely satisfactory for sandy or loam soil. It can be operated at a fuel and labor cost of 20 or 30 cents per acre. Twenty to twenty-five acres can be plowed per day. It is necessary to have a 15 to 20 horse power tractor or its equivalent to operate the 8-foot Wheatland satisfactorily on the sandy or red Piedmont soils tested.

Cutting Oats and Planting Peas: A method of cutting oats and planting peas at the same operation was developed by pulling the binder, Wheatland plow, and grain drill with a 15-30 tractor. The labor and fuel cost was 23 cents per acre and the peas were sown two weeks earlier than they could have been if the oats were shocked in the field.

Pea Hay Curing: Experimental work was conducted on the curing of pea vine hay in the windrow with the side delivery rake. This was found to be economical of labor. A high quality of bright green hay was produced. The curing was hastened by turning windrows with the rake.

Corn Binder Test: Tests made with a corn binder showed that approximately twice as much cane could be hauled with the same amount of time and labor as when cut by hand.

Snapping Cotton Study: A test of snapping cotton at Decatur showed this method to be applicable to conditions in that vicinity. Savings of from two to four dollars per bale were shown after a slight loss for grade was deducted. Over one-half the time of gathering was saved.

Shave Plow Test: Tests with the new shave plow show it to be satisfactory for sandy or loose soil, free from rocks, roots and large gravel. The capacity is approximately twice that of a 12" mouldboard plow. It can be pulled by two 1200 pound mules.

BOTANY AND PLANT PATHOLOGY

Some Factors Affecting the Composition of Sweet Potatoes. (Wright A. Gardner).—The early changes in composition of the potatoes of the 1928 crop were small and not readily related to rainfall. The late season changes in composition seem to be more closely related to the changes in soil moisture. The general tendencies were as reported in other years. Earlier results on the effects of removing tops were confirmed. They show that potatoes with tops removed were higher in percentage moisture and sucrose, and lower in percentage total carbohydrates and starch than untreated potatoes. The effects of frost were similar to those of 1926; frosting of tops caused an increase of percentage moisture and sucrose and a decreased percentage of total starch and total carbohydrates. Curing caused a shrink-

age of about 2 per cent. Cured, dry ventilated potatoes shrank 2 to 4 per cent more than cured, humid ventilated potatoes. The lot of cured, dry stored, unventilated potatoes rotted by fermentation and fungus action more than the lot of uncured, humid stored, and humid ventilated, or those of any other treatment. Results on changes in composition due to different treatments confirm those of previous years.

Decomposition of Chlorophyll in the Rinds of Satsuma Oranges. (Wright A. Gardner).—Recent results show that although acids decompose chlorophyll, there is a definite enzyme which hastens the process in the yellowing rinds of satsuma oranges. With the same or a slightly higher hydrogen ion concentration in the unboiled than in the boiled juice, there was greater decomposition of the chlorophyll in the former. Thus a definite catalytic agent is demonstrated in the juice of orange rinds. Attempts to precipitate the active enzyme by means of alcohol were not successful. The enzyme is much less abundant in the green than in the yellow rind of the satsuma orange, and more abundant in the rind of the California than of the satsuma orange.

Resistance of Different Varieties of Sweet Potatoes to Black Rot. (Wright A. Gardner).—One to four hundred plants of each of thirty varieties or selections were inoculated four times as follows: (1) at the time of setting in the field by dipping the roots in a thick suspension of the black rot organism, (2) late in June by pouring a suspension of the spores around each plant, (3) early in August by means of a wire brush dipped in the suspension and applied to the stem near the level of the ground, and (4) late in August by pouring the suspension around each plant. No plant of Dooley and Jersey Sweet and five other varieties; one to four per cent of nineteen other varieties; and more than six per cent of Nancy Hall, and two other varieties, resisted the four attempts to infect with black rot.

ENTOMOLOGY

The Control of Citrus Insects with Oil Emulsions. (L. L. English).—Sixty days were required for the completion of the first generation of purple scale (Lepidosaphes beckii Newm.) Fifty-six to sixty days were required for the completion of the first generation of white-fly (Dialeurodes citri Ash.).

Injury to satsuma trees resulting from the application of oil emulsions may be manifested as "shot holes", "corky areas", "burn", defoliation, fruit drop, or failure to set a crop of fruit. Unsaturated oils are more likely to cause damage in any of the forms than the saturated oils. Spraying in the late fall with oils is hazardous on account of the cold injury.

Against the overwintering larvae of white-fly, the more viscous oils (80 to 140 Saybolt) gave satisfactory control at an oil

concentration of 1.5 per cent. A satisfactory kill of purple scale was not obtained by one application of oil at 2 per cent (oil basis) to heavily infested trees.

Life History of Belted Bean Beetle. (J. M. Robinson).—The summary of the average of all broods, from July 21 to September 26, 1928 reveals 6.1 days as the average incubation period. The range was from three to seven days. In the larval development there were three distinct instars. The first instar required 4.5 days on the average, the range being from three to seven days. The second instar developed in 4.2 days on the average, the range being from three to six days. The third instar consisted of two distinct divisions; namely, the active period and the quiet or pre-pupal period. The average length of days for the development of the active period of the third instar was 4.2 days, the range being from two to seven and one-tenth days. The pre-pupal or quiet period of the third instar required on the average of 5 days, while the range was from three to six and seven-tenths days. The total larval development period including all instars was on the average 18.3 days, the range being from fifteen to twenty-one days. The average developmental days of the pupal period was 5.4 days, the range being from 4 to 7.2 days. The average number of days for the total development was 29.8, the range varying from 27.2 to 33 days. There were four complete generations from July 21, 1928 to June 21, 1929.

The egg deposition records of the overwintering adult beetles in 1928-1929 revealed that the females deposited eggs throughout the winter. The minimum temperature was 21 degrees Fahrenheit. One hundred and eight female beetles deposited 21,321 eggs from November 18, 1928 to April 30, 1929. The average number of eggs per deposition was 37, the minimum being 1 egg, and the maximum 125 eggs. The average number of eggs deposited per individual was 197 eggs, the range being from 2 to 970 eggs.

Boll Weevil Control With Calcium Arsenate. (J. M. Robinson and F. S. Arant).—The work on boll weevil control was continued in 1928 on three soil types; namely, Norfolk sandy loam, Cecil clay, and Houston clay. The Norfolk sandy loam plots were on the agricultural experiment station farm. The Cecil clay plots were in Lee county, and the Houston clay plots were in Montgomery county.

Dusting on the Norfolk sandy loam plots produced quite variable results. The heavy rains following the applications of fertilizer at bedding time and nitrate of soda after chopping, caused a very irregular growth of the cotton plants; the total yield for the season was thereby reduced. The infestation on the dusted plots did not reach ten per cent until August 10. Three applications of calcium arsenate kept the infestation below 20 per cent until September 7. The infestation on the undusted

plots did not reach ten per cent until August 27. As a result of the low early infestation, the gain from dusting was correspondingly low. The increase in yield from poisoning was 195 pounds of seed cotton per acre on the plot treated with 500 pounds of fertilizer; with 1000, 1500, and 2000 pounds of fertilizer the increase in yield was 494, 340, and 142 pounds of seed cotton per acre, respectively. There was a loss of 30 pounds of seed cotton per acre for dusting on the unfertilized plots. The five-year average increase in yields for dusting was dependent upon the rate of fertilizer and the per cent of infestation. Without fertilizer, dusting increased the yield only 27 pounds of seed cotton per acre. Such a gain is not profitable. With 500 pounds of fertilizer the increase was 239 pounds per acre; with 1000, 1500, and 2000 pounds of fertilizer the increases from poisoning were 391, 372, and 287 pounds of seed cotton per acre, respectively. These results show quite conclusively that dusting is profitable if the potential yield is one-half bale or more per acre, and if the infestation exceeds ten per cent during the time the crop is being set.

The infestation on the heavy red clay was 20 per cent on the dusted plot June 27. Six dustings kept the infestation below 20 per cent, with one exception, until August 28. The infestation on the undusted plot varied from 4 to 44 per cent during the same period. The average infestation was 10 per cent on the dusted plot; on the undusted plot it was 17 per cent. The fourth dusting was affected by rain within twenty-four hours. The gain from dusting was 490 pounds of seed cotton per acre. The five-year average infestation was 11 per cent on the dusted and 25 per cent on the undusted plots. The five-year average gain from dusting was 282 pounds of seed cotton per acre as contrasted with the 490 pound gain in 1928.

The infestation on the Houston clay "Black belt" plot was 16 per cent June 19. Three applications of calcium arsenate reduced the infestation to 6 per cent July 12. Two additional applications of dust kept the infestation below 20 per cent until August 17. The infestation on the undusted plot gradually advanced to 50 per cent over the same period. Three dustings, August 24, 27, and 29, did not reduce the infestation due to weevil migration and the reduced squaring activities of the cotton plant. The half-grown bolls, however, were protected. The gain from dusting was 372 pounds of seed cotton per acre. The five-year average infestation was 27 per cent on the undusted and 17 per cent on the dusted plots. The five-year average gain from dusting was 258 pounds of seed cotton per acre as contrasted with the 372 pounds gain in 1928.

FARM MANAGEMENT

Labor Required and Cost of Producing and Storing Corn and Sorghum Silage. (J. F. Duggar).—The average labor expendi-

ture in 1928 in producing and storing a ton of sorghum silage was 0.86 of one day of man labor and for a ton of corn silage 0.93 of a day.

The average cost of producing and storing a ton of sorghum silage in 1928 was $3.76 and a ton of corn silage, $4.86.

The average labor expenditure in 1928 in producing and storing silage was 0.86 of one day of man labor and for a ton of corn silage 0.93 of a day.

The average figures above are based on the production in 1928 of 2090 tons of corn silage and 1907 tons of sorghum silage, on 27 fields located in the western, central, and eastern parts of the state, the majority being in the Central Prairie region. The charges include interest and depreciation of equipment, $1.00 per day for labor, $1.00 a day for each mule, and $5.00 a day for rent and taxes.

Cost of Oats. (J. F. Duggar.)—Repeated severe freezes in the first week of January, 1928, killed practically all fall sown oats on farms in Central Alabama where cost records were being kept for this study. On a part of these fields oats were resown in January and were subjected to an unusually favorable season for "spring oats". The result on 12 farms was an average yield of 22.7 bushels per acre and an average cost of 53.7 cents per bushel.

Unusual Summer Legumes. (J. F. Duggar).—In a collection of summer legumes tested in rows the following kinds showed special promise in luxuriance of growth and prolific seeding habits; Crotalaria sericia, Crotalaria striata, Sesbania, and Florida beggarweed.

On Norfolk sand loam soil without artificial inoculation, no tubercles developed on the roots of the erect jack or sword bean, lima bean, Sesbania, Daubentonia, white Shrankia, black locust, or Dolicholus minimus. On the other hand no artificial inoculation was required to produce abundant nodule formation on the roots of moth bean, mung bean, Strophostyles helvola, and on all species of Crotalaria tested.

Time Required for the General Appearance of Root Nodules. (J. F. Duggar).—For the plantings made near October 1 in the falls of 1925, 1926, and 1927 the average number of days between the appearance of the seedlings above ground and the presence of one nodule or more on at least 85 per cent of the plants averaged as follows:

	Days		Days
Monantha vetch	6.67	Austrian Gray Winter pea	6.67
Woolly-pod vetch	7.33	Tangier pea	8.00
Hairy vetch	8.33	Sweet pea (Spencer mixed)	16.67
Hungarian vetch	8.33		
Bitter vetch	12.33	Scotch vetch	17.00

By deferring planting beyond the first week in October, with consequent decrease of temperatures to which the seedlings were

subjected, the interval was markedly increased between germination and generalized nodule formation. For example, in three-years' experiments this interval averaged for hairy vetch planted about the first of October only 8.33 days, the first of November, 10.67 days, the first of December, 24.33 days. Likewise the corresponding nodulation periods for Austrian Gray Winter pea averaged for the October planting 6.67 days, the November planting 13.33 days, and for the early December planting 28 days.

Alfalfa Failure Caused by an Insect. (J. F. Duggar).—In recent years in the Alabama Black Belt alfalfa has declined greatly in yield and in thickness and duration of stand (especially in the cuttings made after hot weather begins.) The most conspicuous symptom is the yellowing of foliage. In 1927 this had been found to be connected with characteristic wounds or girdles on each stem thus affected. In the summer of 1928 in all such fields examined an insect was found in such numbers and position with reference to the wounds as to indicate that it was the cause of the prevailing injury to alfalfa. This was identified by Dr. W. D. Funkhouser as the three-cornered alfalfa hopper (Stictocephala festina Say).

The percentage of branches girdled by this insect in counts of random samples from seven alfalfa fields averaged 38. Repeatedly the unthriftiness of the plants or the thinning of the stand was found to vary with the number of insects or of insect wounds.

In the laboratory both the immature and the winged stages of the three-cornered alfalfa hopper were readily killed by blowing through the wire cages in which they were confined the dust of common contact insecticides, including a nicotine preparation, pyrethrum, and diluted sodium fluosilicate. Field tests with insecticides have been planned for next season.

The habits of the insect suggest that their injury to alfalfa may be decreased by fall planting, by completely eradicating, some months in advance of sowing, any adjacent growth of thin alfalfa or sweet clover, and by forcing alfalfa into rapid growth by the choice of suitable soil and by the use of phosphate.

HOME ECONOMICS

The Physical Condition of the Children of Lee County. (Helen Dumond Herren.—This study was undertaken in order to determine the percentage of rickets among children in Alabama and an investigation of factors producing it. It also involved other skeletal malformations, the state of nutrition and physical condition of the children, and an examination of factors contributing to these conditions.

Data were collected concerning the dietary regime of all the babies of Lee county between the ages of 6 months and 3 years.

Clinics were held April 7-11, 1929, at convenient locations. All babies (179) were examined by Dr. M. W. Glasgow, Chief Pediatrician, Tennessee Coal, Iron and Railroad Company Hospital, Fairfield, Alabama, for any physical maladjustments and for the state of nutrition. These were then examined further by Dr. Martha Eliot, director, Child Hygiene Division, Children's Bureau, Washington, D. C., for any clinical signs of rickets or skeletal malformation. X-ray pictures were made of the bones of the wrists by Dr. B. F. Thomas of Auburn. These were made under the direction of Dr. Eliot who is at this time interpreting them.

Auburn and Opelika were found to have a much larger percentage of babies in good condition than the rural districts, Opelika Mill village and Pepperell Mill village. Auburn had 80 per cent and Opelika 71 per cent in good condition, while there were 69 per cent of the rural babies, 66 per cent of Opelika Mill village, and 72 per cent of Pepperell Mill village babies in an undernourished condition.

Babies in Auburn, Opelika, and the rural district were found to be superior in height to the mill babies. Seventy-two per cent of the Auburn babies were above average height for their age, while 74 per cent of the Opelika Mill babies were below average height.

Two and one-half pints of milk in the mother's diet during pregnancy was found to be the optimal amount for lactation. Only one mother (.8 per cent) of 122 getting 3 pints of milk to drink besides some in food, was unable to nurse her child, while 58 per cent of the mothers getting no milk were unable to nurse their children. Milk added to the diet of the mother following delivery failed to produce milk of sufficient quantity or quality for lactation.

HORTICULTURE

Variety Tests With Pears. (C. L. Isbell and O. C. Medlock). —About 1912 a few trees of several varieties were planted to obtain data on the ability of different varieties to resist blight and produce fruit when grown under grass sod culture without the addition of fertilizer. The planting contained varieties very susceptible to blight, varieties supposed to be resistant to blight, and hybrids that are more or less resistant to blight.

All the trees of the varieties that are very susceptible died from blight as they came into bearing. Hybrid varieties of which the Kieffer is an example have blighted some most years, but not enough to prevent heavy production. The variety sold as Pineapple or sand pear has proved entirely blight resistant, but the blooms appear so early in the spring that they have been killed by cold every year except 1925 and 1928. A seedling sand pear that has fruited three years and has not blighted has been added to the planting. It does not bloom early enough in

the spring for the blossoms to be killed by late spring frost. The fruit it produces, when well ripened, has fair quality. If this pear proves to be absolutely blight resistant it has much promise as a pear for home use.

Grape Variety Test. (C. L. Isbell and O. C. Medlock).—During the winter of 1924-25 a planting of three vines of each of fifty different varieties was made primarily to compare hybrid varieties derived from different species (Vitis aestivalis lincecumii, Vitis champini, Vitis rupestris, and Vitis riparia) of southern wild grapes with a few of the standard varieties. These vines have been bearing for three years. Table 5 shows the color. date of ripening, average yield for three years, and indicates the quality of the ten varieties that have shown most promise.

Table 5.—Color, Date of Ripening, and Average Yield of Ten Promising Grape Varieties

Variety	Color	Date of ripening	Average yield per vine in lbs.	Quality of fruit
Armalaga	greenish-yellow	7/20-8/10	6.12	fair
Champanel	black	7/29-8/10	6.17	poor
Concord*	black	7/15-8/9	6.34	good
Lomanto	dark purple	7/7-7/24	6.64	fair
Manito	dark purple	6/25-7/21	9.92	very poor
Marguerita	dark purple	8/10-8/30	6.54	fair
Meunch	black	8/1-8/20	5.69	good
Munson	black	7/11-7/30	5.52	good
Niagara**	greenish-yellow	7/11-8/13	5.56	good
Rommel	greenish-yellow	7/7-8/6	7.44	good

*Standard variety of blue or black.
**Standard variety of light or greenish yellow.

Tung-Oil Nut. (C. L. Isbell).—From 1908 to 1910 seedling tung-oil nut trees were planted on the experiment station grounds to determine how this plant would grow, fruit, and endure the winters in this section. These trees are growing very close together on an area slightly less than 1/10 of an acre. The planting is in the form of a narrow strip bordered on the south by a mature forest and on the north by a cultivated field.

The trees have made fair to good growth; most of them have been fruiting for the last few years. Nuts produced by different trees vary in size and number per cluster. The yield has increased as the trees have increased in size. The total yield for 1928 was between 1,000 to 1,200 pounds. Some of the trees have been damaged and a few have been partially or entirely killed by low temperatures.

Three trees which probably were planted about 1910 on a poor hill on the campus have been under observation. One of these has died, apparently from cold injury. The others are making fair growth and fruiting well.

Variety and Date of Seeding Tests with Vegetables. (C. L. Isbell).—During the year tests were started with several of the common vegetables to determine the effect of variety and time of seeding upon the time of harvest and yield.

Beans.—Successive plantings throughout the season of five varieties of bush snap beans, pole snap beans, and bush lima beans were made. The first planting of the 1929 crop, which was made April 2, matured in time to be included in this report. Table 6 shows yields of green beans, including pods, in pounds per acre.

Table 6.—Time of Harvest and Yields of Different Varieties of Beans

Type of bean	Variety	Time of harvest	Yield in lbs. per acre
Bush Snap	Black Valentine	5/27-6/8	4,476
	Extra Early Red Valentine	"	4,650
	Hastings Excelsior Refugee	"	4,700
	Stringless Greenpod	"	3,500
	Tennessee Stringless Greenpod	5/21-6/8	6,400
Pole Snap	Cornfield	5/31-6/26	5,850
	Ideal Market	"	8,012
	Kentucky Wonder	"	7,938
	McCaslan	"	7,326
	Southern Prolific	"	6,826
Bush Lima	Burpees New Improved	6/17-29	2,350
	Burpees Philadelphia	"	3,462
	Fordhook	"	2,200
	Henderson	"	3,326
	Jackson Wonder	"	4,350

The results show that the Tennesse Stringless Greenpod is the first to produce beans and the heaviest yielder of the bush snap beans. The quality of this bean compared with the other bush snaps grown was low. The Ideal Market and Jackson Wonder yielded more than other varieties of their respective types.

Cucumbers.—Five varieties of slicing cucumbers were planted April 2. When cucumbers were harvested they were graded approximately according to the commercial grades specified by the United States Department of Agriculture. A slight variation

Table 7.—Grade and Yield of Different Varieties of Cucumbers

Variety	Date of harvest	Yield in pounds per acre			
		No. 1	No. 2	Culls	Total
Early Fortune	5/29-7/9	9,950	2,585	2,125	14,660
Extra Dark Evergreen White Spine	"	10,290	2,600	1,620	14,510
Kirley Stay Green	"	13,025	3,100	1,650	17,774
Klondyke	"	12,680	2,695	2,965	18,340
Perfected Davis	"				
Perfect	"	8,345	3,435	2,230	14,010

was made in grading to include all usable cucumbers in either grade No. 1 or No. 2, and all others in culls. The results are shown in Table 7.

Kale.—A planting was made September 25, 1928. Plants were thinned and the thinnings weighed January 21, 1929. By April 10 the remaining plants were beginning to seed; they were then harvested and weighed. Yields are given in Table 8.

Table 8.—Yield of Different Varieties of Kale

Variety	Yield in pounds per acre		
	Thinnings harvested 1/21/29	Harvested 4/10/29	Total yield
Dwarf Green Curled German	2,507	9,592	12,009
Excelsior Moss	436	5,663	6,099
Dwarf Green Curled Scotch	3,052	9,592	12,664
Siberian	5,330	11,336	16,666
Tall Green Curled Scotch	7,630	17,004	24,634

Irish Potatoes.—On February 16, 1929 six varieties were planted. Yields obtained are shown in Table 9.

Table 9.—Yield of Different Varieties of Irish Potatoes in Pounds Per Acre

Variety	No. 1	No. 2	Culls	Total
Cobbler	5,825	1,763	481	8,068
Green Mountain	7,875	631	394	8,900
Lookout Mountain	3,025	1,460	375	4,860
Rose Four	6,225	2,800	619	9,644
Triumph	6,350	2,050	618	9,018
White Star	6,238	2,087	569	8,894

Spinach.—Plantings were made September 25 and October 18, 1928. The first planting came up rather irregularly over a long period and some plants were large enough for use before others of the same variety came up. The last planting came up to a good stand but was a little late for best growth. The first planting was thinned December 5, 1928; the second, January 14, 1929. Thinnings were weighed and included with the weights of the last harvest which was made April 10, 1929. Table 10 shows the results obtained.

Table 10.—Yield of Different Varieties of Spinach

Variety	Yield in pounds per acre	
	planted Sept. 25	planted Oct. 18
Bloomsdale	6,815	5,715
Fill Basket	11,310	6,525
Giant Thickleaf	11,165	5,220
King of Denmark	5,655	4,640
Longstanding	7,250	4,060
Princess Juliana	5,748	3,480
Thickleaf	9,570	6,235
Victoria	8,845	4,005

Sweet Potatoes:-

Table 11.—Yield of Different Varieties of Sweet Potatoes on Thin Norfolk Sandy Soils

Variety	Av. yield in bushels per acre 1926-1928 inclusive
Bunch Porto Rico	118.77
Creola	86.25
Dooly	84.66
Enormous	70.00
Miles Yam	77.65
Nancy Hall	90.78
Pumpkin	44.85
Red Jersey	138.86
Porto Rico	147.39
Southern Queen	134.74
Triumph	134.45
Vineless	80.57
Yellow Jersey	161.79
Yellow Strassburg	65.50

The Jerseys, Porto Ricos, Southern Queen, and Triumph were heavier yielders than the other varieties tested.

The recently introduced red skin Porto Rico, sometimes sold under the name Improved Porto Rico, has been tested for two years. It has the same general quality and shape and it is yielding about the same as the regular Porto Rico.

The Big Stem Jersey is being tested, but it has been difficult to obtain disease-free seed in sufficient quantity to continue the test. It promises to be a very heavy yielder when clean seed is available.

Turnips.—A planting of two varieties commonly grown for greens and three varieties grown for greens and roots was made March 20. All varieties were thinned during the early part of the growing season before storage roots were formed. When the storage roots developed the plants were harvested and weighed and the weight of all plants with roots less than one inch in diameter was added to the weight of thinnings. Results obtained are shown in Table 12.

Table 12.—Yield of Different Varieties of Turnips

Variety	Yield in pounds per acre	
	Tops including roots less than one inch in diameter	Roots one inch in diameter and over with tops included
Golden Ball	12,062	1,400
Purple Top Globe	30,000	13,800
Seven Top*	15,250	1,600
Southern Prize*	18,188	2,650
White Egg	16,700	5,000

*Foliage types.

Fertilizer Experiments with Cabbage, Mobile County. (R. W. Taylor).—Experiments with cabbage were conducted to determine (1) the influence of time of application of complete fertilizer, (2) the influence of source of nitrogen applied when plants are set when supplemented with nitrate of soda as side dressing, (3) sulphate of ammonia and nitrate of soda as sole source of nitrogen, and (4) the influence of different amounts of each fertilizer element with constant amounts of the other two.

There were four experiments in which times of application were compared and two in which sources of nitrogen and amounts of fertilizer were compared. Each treatment was duplicated in each experiment.

An application consisting of 1,000 pounds of superphosphate 250 pounds of nitrate of soda and 100 pounds of muriate of potash per acre applied before the plants were set and supplemented with side dressings of 500 pounds and 250 pounds of nitrate of soda applied in February and early March, respectively, was used as the standard with which other treatments were compared.

In experiments comparing times of application, where all fertilizer was withheld at the time of setting and applied as side dressing early in February, the yield in 100-pound (net weight) crates was 198 per acre as compared with 209 crates where fertilizer was applied before setting. In the first case 17 per cent of the crop was harvested early while 25 per cent was cut early where fertilizer was applied before setting.

Cottonseed meal, sulfate of ammonia, and nitrate of soda were compared as sources of nitrogen when applied before setting the plants to supply one-fourth of the total nitrogen and supplemented with nitrate of soda side dressings. The fertilizer treatment with cottonseed meal produced 244 crates per acre, with sulfate of ammonia 208 crates, and with nitrate of soda 222 crates. Sulfate of ammonia as the sole source of nitrogen produced 182 as compared with 218 crates produced with nitrate of soda as the source of nitrogen. The heads were smaller and firmer where sulfate of ammonia was used.

In experiments comparing different amounts per acre of each fertilizer element in complete fertilizer, the yield where 500 pounds of nitrate of soda per acre was applied was 197 crates per acre, while with 750 pounds it was 223 crates. The yield where 250 pounds of superphosphate was used, was 193 crates per acre, while with 500 pounds it was 221 crates. Where no potash was applied the yield was 190 crates per acre, while with 50 pounds per acre the yield was 220 crates. Larger amounts of each fertilizer material than those mentioned increased the yield only slightly or not at all.

Effect of Spacing Upon Yield of Irish Potatoes, Baldwin County. (R. W. Taylor).—Different hill spacings were com-

pared using one ounce seed pieces. The yield per acre increased with increased spacing from 8 to 14". Hills spaced 12" in the row produced 67 bushels of No. 1 and 43 bushels of No. 2 potatoes. Hills spaced 14" produced 71 bushels of No. 1 and 47 bushels of No. 2 potatoes, while the yield per acre with 16" spacing was 52 bushels of No. 1 and 32 bushels of No. 2 potatoes.

Experiments with Fertilizers for Bearing Pecans, Dallas County. (R. W. Taylor).—Stuart pecan trees of about 20 years of age growing on Norfolk fine sandy loam soil were selected for experimental purposes in 1926. Plot 1 received an application of 20 pounds of basic slag and 2½ pounds of muriate of potash per tree in 1927 and 1928. Plot 2 received 10 pounds of nitrate of soda per tree per year in addition to the amounts of phosphate and potash used in plot 1. Plot 3 received a double application of the same grade of fertilizer as plot 2. Plot treatments and yields are shown in Table 13.

Table 13.—Influence of Fertilizer Treatment Upon Yield of Stuart Pecans

Plot No.	No. of trees in plot	Fertilizer treatment	Av. yield per tree 1926-27	Av. yield per tree 1928	Increase*
1	11	P–K	4.49 pounds	6.46	1.97± .77 lbs.
2	9	P–N–K	3.90 "	11.80	7.93± .91 lbs.
3	11	2P–2N–2K	4.55 "	16.00	11.53±1.49 lbs.

*Average increase in 1928 above individual tree yields of 1926-1927.

Dusting Experiments for the Control of Pecan Scab, Dallas County. (R. W. Taylor).—Pabst and Success pecan trees were dusted with 80-20 hydrated lime-monohydrated copper sulphate dust in an attempt to control scab. Five applications were made at three-week intervals starting May 18 and ending August 8, 1928. Scab was first observed on Pabst foliage June 8. A few spots were present on the nuts June 30 and by July 20 the nuts were very spotted. The Success variety was still comparatively free of scab July 20.

The percentage increase due to dusting, on the basis of weight of whole nut, was 22 for Pabst and 22.8 for Success. The increase on the basis of weight of shelled meat was 31.7 for Pabst and 34.9 for the Success variety. It appears that in this orchard which has been heavily infected for a number of years that dusting at intervals shorter than three weeks will be necessary for satisfactory control.

Effect of Fertilizer on Carrying Quality of Strawberries. (W. D. Kimbrough).—Studies of the effect of fertilizer treatment on strawberries were continued. Vigor of plant growth varied considerably with the fertilizer treatment. Excessively vigorous plants were grown on plots near Cullman, Alabama, when 400 pounds of nitrate of soda were applied in the spring.

Judged by their condition on arrival after being shipped by express or transported by automobile a distance of over two hundred miles, the carrying quality of berries from these plants was not as good as that of berries from less vigorous plants. It seems evident that fertilizer treatment may effect the carrying qualities of berries, but the extent of this effect is probably not as great as has been thought. The carrying quality of berries from plants of the same vigor receiving nitrogen from nitrate of soda or cotton-seed meal was the same so far as could be determined. Heavy applications of muriate of potash did not improve the carrying quality of strawberries.

Effect of Fertilizer on Yield and Quality of Irish Potatoes and Watermelons. (W. D. Kimbrough).—Studies on the effect of fertilizer treatment on Irish potatoes and watermelons were continued. There was no apparent difference in keeping of Irish potatoes grown in the spring of 1928 and stored over winter due to fertilizer treatment. Potatoes from all plots kept well. Some variation was found in the analysis of potatoes from different plots. Those from the less vigorous plants had a lower moisture content and a higher starch content. Differences apparent after digging remained during the storage season. No appreciable difference was found in tubers grown on plots fertilized with muriate or sulfate of potash.

Potatoes grown on new ground in the spring of 1929 responded to N, P, and K. The greatest response was from N and the least from K. Sulfate of potash gave very slightly better yields than muriate of potash. Nitrate of soda and sulfate of ammonia both gave larger yields than did cottonseed meal when used as the source of nitrogen. Muriate of potash added as a side dressing to potatoes receiving complete fertilizer gave an increase in yield.

Nitrate of soda which was applied to watermelons in varying amounts and at various times gave a good response in plant growth. The sugar and moisture content did not vary appreciably with fertilizer treatment. Nitrate of soda applied when melons were half grown did not injure the quality of the melons. No correlation was found between nitrate of soda, applied at any time, and the occurrence of white heart in melons. No indication was found that the fertilizer treatment affected the keeping quality of the melons.

AGRICULTURAL SUBSTATIONS

The Tennessee Valley Substation. (M. J. Funchess).—This year marked the beginning of operations on the Tennessee Valley Substation located two miles north of Belle Mina in Limestone county. This farm of 240 acres was bought by Limestone county officers at a cost of $28,000. All of the land is suitable for cultivation except ten or twelve acres in timber. A residence for

the superintendent, a residence for an assistant, five labor cottages, a barn, a tool shed, an office building, a garage, a 60-foot poultry house, and a well house constitute the building layout. These buildings were all completed during the late winter months.

During the year the following experimental work was started:

1.—Experiments dealing with the newer sources of nitrogen on both limed and unlimed plots.
2—Experiments dealing with sources of nitrogen involving the more common kinds of nitrogenous fertilizer.
3.—Experiments dealing with cotton and corn varieties.
4.—Experiments dealing with different fertilizer formulas for both cotton and corn.
5.—Rotation experiments comparing continuous culture with several two-year rotations and several three-year rotations.
6.—A two-year rotation planned to make maximum use of soil building crops.
7.—Variety trials of a large number of truck crops.
8.—Fertilizer experiments with a large number of truck crops including cantaloupes and Irish potatoes.
9.—A home orchard containing important fruits and nuts suited to the region was set out.
10.—A two hundred unit poultry flock was started.

Forty acres of this farm have been fenced with standard wire fence and pasture grasses and clovers planted in preparation for development of a dairy unit. It will be impossible to start this unit, however, until new funds are provided for the construction of a dairy barn and milk house and the purchase of a dairy herd. The areas around the residences, labor cottages, and barn have all been set with lawn mixtures with the hope of having an attractive lawn. A landscape plan has been worked out and much of the shrubbery planted.

During the next two months the experimental work on this station will be much enlarged so as to cover the important fertility problems such as the use of lime, the use of phosphorus in different forms, the use of potash at different rates, and additional experiments of this character.

The Sand Mountain Substation. (M. J. Funchess).—The Sand Mountain Substation consists of 240 acres of land purchased by DeKalb county officers aided to the extent of several thousand dollars by private subscriptions. The total cost of the farm was $24,100.00. This farm is located in the southern part of DeKalb county about ten miles west of Collinsville and about fourteen miles east of Albertville.

Building equipment, finished during the late spring months, includes a residence for the superintendent, an office building, three labor cottages, a barn, a tool shed, a poultry house, a ga-

rage, and a well house. Three old farm residences, already on the farm, were repaired and painted. An old barn was repaired and recovered.

Several acres of land have been cleared by the superintendent to improve the appearance of the farm. Another area near the barn has been cleared and fenced with standard wire fence to provide pasture for the livestock kept on the farm. There still remains a sufficient quantity of timber on the farm to provide fuel for all employees. Cutting of trees for fuel will be carefully controlled by the superintendent so as to maintain the farm wood lots.

During the year the following experimental work was started:

1.—Experiments comparing the more common sources of nitrogen.
2.—Experiments with different fertilizer formulas for cotton and corn.
3.—Variety trials of both cotton and corn.
4.—Rotation experiments comparing continuous culture with several two-year and three-year rotations.
5.—Variety trials of a large number of truck crops.
6.—Fertilizer trials with a large number of truck crops.
7.—A home orchard of adequate size to provide fruit for all employees.
8.—Variety trials of oats including certain cold-resistant kinds.

Much of the land on the Sand Mountain Station is rolling and erodes very easily. The superintendent has terraced very carefully much of the land that is too rolling to be used for experimental purposes.

The outstanding results obtained in the few experiments in progress indicate the great need for nitrogen in crop production. The yields of both cotton and corn vary almost directly with increasing amounts of nitrogen.

During the next two months the experimental work on this station will be expanded materially. Unfortunately this station does not contain many acres of land suitable for field experiments. It will be necessary, therefore, to start on this station only the most important experiments and omit many that are very desirable.

The Wiregrass Substation. (M. J. Funchess).—The Wiregrass Substation is located in Henry county about one and one-half miles east of Headland and ten miles north of Dothan. The area of this farm is 220 acres. The purchase price was $26,800. All of the land on this farm is in cultivation, or in pasture, except about one acre that is not to be used for agricultural purposes. The soil is quite representative of the Wiregrass territory.

The building equipment on the farm includes a residence for the superintendent, a residence for an assistant, four labor cot-

tages, an office building, a barn, a storage house, a tool shed, a poultry house, a garage, and a well house. These buildings were all completed during the last few weeks of the calendar year. While building operations were in progress the superintendent rented living quarters in Headland at his own expense. The old barn and labor cottages were used to carry on operations during the season. Such a late start was obtained in farming operations that almost no experimental work was attempted during the growing season. Much of the land was fallowed throughout the summer in the effort to get rid of Bermuda grass. An adequate supply of grain and hay was produced to provide for the farm animals during the next year. A large pond on the land has been drained and this drained area is now being prepared for a permanent pasture. All of the land that required terracing has been very carefully terraced. All old fence rows have been thoroughly cleared up and open ditches dug along some of the land lines to take care of flood water.

During the fall months an experiment was started comparing continuous cropping with several two-year and three-year rotations. A two-year rotation was started to study the conditions most favorable for legume production as a means for building up land.

The lands that are suitable for experimental work have been carefully studied and the areas measured and marked out in preparation for starting a complete set of experiments during the spring of 1930. A home orchard and vineyard have been started. A large home garden has been planned for the purpose of growing vegetables for all employees.

The Gulf Coast Substation. (M. J. Funchess).—The Gulf Coast Substation was established during the latter part of September 1929. The area provided includes 720 acres of land and cost approximately $26,000. This farm is located two miles northeast of Fairhope in Baldwin county. Building operations have just been started at this date, January 15, 1930. This statement is made to complete the history of the substation. There is no further report to be made at this time.

The Black Belt Substation. (M. J. Funchess).—The Black Belt Substation was established during the last week of September, 1929. The area contains 1,116 acres. It is located two miles west of Marion Junction in Dallas county. It cost approximately $43,000. As yet there are no farming operations on this station, since there are no buildings provided. A contract for the construction of buildings may be let on February 26, 1930. This historical statement concludes the report on the Black Belt Substation.